SITE REASSESSMENT

AMERICAN CYANAMID LANDFILL

SA-293

CARTERET
MIDDLESEX COUNTY, NJ

EPA ID No. NJD986603439

VOLUME 1 OF 1

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF REMEDIATION SUPPORT
BUREAU OF ENVIRONMENTAL MEASUREMENTS AND SITE ASSESSMENT

AMERICAN CYANAMID LANDFILL, CARTERET
DRIFTWAY STREET
MIDDLESEX COUNTY
CARTERET, NEW JERSEY 07008

LATITUDE: 40° 35' 43 NORTH LONGITUDE: 74° 13' 16" WEST

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MAPS

ATTACHMENTS

3) Van Veldhuisen, Donna, NJDEP. American Cyanamid Landfill, Carteret, Middlesex County. Site Inspection Report. January 1992.

4) Maltese, Dan, NJDEP. American Cyanamid Landfill - Carteret, Carteret Boro, Middlesex County. Preliminary Assessment Report. March 25, 1991.

5) Corcory, Ronald T. NJDEP. Amendment to the September 5, 1990 Administrative Consent Order. July 6, 1993. (2 pp.)

6) Blasland, Bouck and Lee Engineers and Scientists. Remedial Investigation Workplan, Carteret Impoundments Borough of Carteret, New Jersey for American Cyanamid Company. December 1993.

7) Blasland, Bouck and Lee Engineers and Scientists. Remedial Action Plan Addendum. Carteret Impoundments Borough of Carteret, New Jersey for Cytec Industries, Inc. November 1994 revised February 1995.

8) Blasland, Bouck and Lee Engineers and Scientists. Annual Monitoring Report for 1999. Cytec Industries Inc. Carteret, NJ. September 1999.

9) Jerome, Joel, Manager - Site Remediation, Cytec Industries, Inc. Letter to Mr. Haiyesh Shah, Case Manager, NJDEP. Re: 2001/2002 Surface Water Monitoring Results, Carteret Impoundments, Carteret, NJ. July 2002. (6 pp)

10) Hallinger, Kris D. Blasland, Bouck and Lee Engineers and Scientists. Letter to Haiyesh Shah, Case Manager, NJDEP. Re: Request for No Further Action Letter and Covenant Not to Sue. Cytec Industries, Inc. Carteret Impoundments Site. Carteret, NJ. September 19, 2002. (2 pp)

11) Missouri Census Data Center. Geographic Correspondence Engine with Census 2000 Geography. Population Ring Data.

Introduction

The United States Environmental Protection Agency (EPA) has tasked the New Jersey Department of Environmental Protection (NJDEP) with a Site Reassessment to gather and evaluate information on the American Cyanamid Landfill site (ACL), also known as the Carteret Impoundments, in Carteret, Middlesex County, New Jersey (CERCLIS ID NJD986603439). The purpose of the Site Reassessment is to determine whether further action under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) is needed. (Attachment AA)

In September 2002, the NJDEP issued a No Further Action (NFA) determination for the site.

American Cyanamid (Cyanamid) operated a chemical manufacturing plant known as the Warners Plant in Linden, New Jersey. Waste byproducts resulting from the plant operations were piped via an underground piping system beneath the Rahway River to the ACL. Cyanamid managed the investigative and remedial activities at the ACL until 1991. In 1991, Cyanamid consolidated its chemical business into a separate division called Cytec Industries, Inc. Cytec took over the Warner plant operations and the management of the ACL environmental investigations. The September 2002 NFA acknowledged the completion of remedial and investigative activities pursuant to NJDEP's Technical Requirements for Site Remediation (N.J.A.C. 7:26E) for the entire site (Attachment 1). This Site Reassessment Summary letter report provides a description of the ACL site, a discussion of remedial efforts, restrictions and engineering controls in place at the site, and a hazard assessment including a site score.

Site Location

The ACL is situated on 124.5 acres of land located along the Rahway River approximately 2,000 feet before its confluence with the Arthur Kill. (Maps 1 and 2) The New Jersey Turnpike is located approximately 0.75 miles to the west of the landfill. The site occupies Block 9.03, Lot 21; Block 10, Lots 8, 9, 10, 12 through 21; and Block 11.01, Lots 8, 10, 11, 12, 13, 14 and 28 in Carteret, Middlesex County (Map 3). The area around the ACL is zoned for industrial use only. Map 4 is a Middlesex County Road Map in the vicinity of the ACL.

The land use surrounding the site consists of the Rahway River to the north and east. American Oil Company and Phillips Petroleum operate adjacent petroleum storage facilities to the south and southeast property boundaries respectively. The Borough of Carteret owns a closed municipal landfill to the west, across Cross Creek. Industrial Reclamation Service, Inc. operates a salvage yard along the western property boundary. The salvage yard had encroached onto the ACL property prior to the installation of the monitoring wells. A variety of metal debris and vehicles were removed from the ACL prior to the monitoring well installation. Cytec believed that a number of organic compounds detected in the ground water on the ACL property had migrated onto the property from the salvage yard.

Site History

Cyanamid was a large, diversified, chemical manufacturer specializing in pharmaceutical products, medical devices, consumer products and agricultural herbicides and pesticides. The Warners Plant produced alum and yellow prussiate of soda (YPS). Alum is an aluminum

sulfate commonly used as a flocculating agent in the treatment of drinking water and YPS has a variety of practical uses including anti-caking of table and road salts, film development, electroplating, dyeing of textiles, and trace metal removal.

Alum was produced from the digestion of bauxite ore with sulfuric acid. The resulting acidic alum muds were slurried with water and neutralized by adding sodium hydroxide. YPS was produced from the reaction of calcium cyanide with ferrous sulfate to form sodium ferrocyanide. These resulting alkaline muds, consisting primarily of calcium carbonate, were also slurried with water and neutralized. Wastes from both processes were conveyed to the ACL via an underground piping system and the combination of the two sludges resulted in a near-neutral sludge. In between the batch discharges of the slurried wastes, the pipeline was continuously purged with untreated water from the Arthur Kill to prevent the 'muds' from settling into the pipeline. The disposal of the YSP sludge was stopped in 1970 and the disposal of the alum sludge was halted in 1973 when all sludge disposal at the landfill ceased.

Cyanamid initiated construction of the landfill in 1939 in an area consisting primarily of wetlands. The 124.5-acre landfill site was divided into a series of six unlined impoundments. The sludge wastes from the plant were piped through underground lines that crossed the Rahway River before being deposited into the six unlined impoundments where it was slowly dewatered. The impoundments were constructed of wooden and earthen dikes and covered approximately 100 acres of the site. The six impoundments differed in size and capacity and the amount and thickness of residues in each of them varied. The combined impoundments are estimated to contain just under two million tons of sludge (attachment 3, page 3-2).

Supernatant from the slurried wastes, and overflow resulting from purging the pipelines eventually drained into the Rahway River, which formed the northern and eastern boundary of the ACL. The discharge to the Rahway River was identified on Cyanamid's original NPDES permit application dated July 10, 1974 and designated as outfall 007. According to the original permit application, contaminants known to be present in the discharge from outfall 007 included, but were not limited to cyanides, aluminum, arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc. Cyanamid claimed that many of these contaminants were associated with the untreated Arthur Kill water used for purging the pipeline rather than the company's manufacturing processes (attachment 2, page 2-3).

During the 1970's, the landfilled sludge material dried and winds blew particulate matter into the air, on to adjacent properties, and into the Raritan River. Under an Amended Consent Judgement issued by the Superior Court of New Jersey - Chancery Division issued in 1978; Cyanamid initiated an investigation to stabilize the landfill in 1981. Due to the nutrient-poor nature of the dried sludge, a material had to be introduced that when combined with the existing sludge would enable the growth of plants. A stable vegetative cover was completed in 1989 after a mix of composted sewage sludge from Camden and Philadelphia was combined with the dried landfilled sludge. The cover served to limit the dispersion of wind-borne particulates and increased the load-bearing capability of the sludge.

Previous Site Investigations

In May 1986, Cyanamid consultants collected and analyzed several sludge samples for the RCRA hazardous waste characteristic of E.P. Toxicity. Based upon the analysis, the sludge samples were not E.P.Toxic. It was also reported that the highest cyanide concentration detected was 103 ppm. This low concentration is not considered to be cyanide reactive. The current NJDEP Non-resident Soil Cleanup Criteria for cyanide is 21,000 ppm.

In October 1986, Cyanamid consultants collected seventeen surface water samples. The surface water samples were collected upstream and downstream of the ACL and at high and low tides. The results of the analysis indicated that all of the samples were below detection limits for cyanide with the exception of one sample. The single sample had a cyanide concentration of 32 ppb. (attachment 3, pg. 3-6) The current NJDEP Surface Water Quality Criteria for human health in freshwater for cyanide is 700 ppb.

Five monitoring well clusters consisting of one shallow monitoring well and one deep monitoring well were installed at the ACL in 1987. (Map 2) The shallow monitoring wells were installed at depths ranging from 10 to 20 feet in the shallow, black organic-rich sand meadow mat and fill material. Four deeper wells were installed in the upper part of the Brunswick Formation with screen depths ranging between 40 and 60 feet. The fifth deep well was screened just above the Brunswick Formation in a gravel layer at a depth of 25 to 35 feet. (attachment 3, page 3-3)

A report titled 'Environmental Assessment of the Carteret Impoundments, American Cyanamid Company, Linden, New Jersey' was prepared by Hydrosystems, Inc. in March, 1989 (attachment 3, pp 3-13 to 3-58). This report summarized the hydrogeologic and water quality conditions at the ACL. Most of the information contained in the report resulted from the collection and analysis of ground water samples during a quarterly monitoring period from July 1987 to October 1988. The data collected from the site was used to prepare the initial Discharge to Ground Water Permit Application. Ground water samples collected from these wells during the routine monitoring exhibited above background concentrations of VOCs, semi-VOCs, inorganics and heavy metals. Specific contaminants detected included but were not limited to benzene, chlorobenzene, toluene, trichloroethene, 1,1-dichloroethane, ethylbenzene, naphthalene, nitrobenzene, cyanides, sulfates, chlorides, ammonia, iron, arsenic, mercury and cadmium.(attachment 2, pg. 2-3) Cyanamid claimed that the VOCs detected in the monitoring wells originated and migrated onto the site from offsite sources. This claim was made because VOCs were detected only in the monitoring wells located hydraulically upgradient of the contaminant sources on the landfill. The adjacent upgradient properties included the closed Carteret Municipal Landfill and a salvage yard. The report concluded that the impact from the ACL on the local ground water and surface water was negligible.

In September 1990, Cyanamid and the NJDEP signed an Administrative Consent Order (ACO) that required Cyanamid to investigate and remediate contamination at the Warners Plant. The NJPDES/DGW permit was withdrawn by the NJDEP coincident with the ACO.

A 'Preliminary Assessment of the American Cyanamid Landfill' was prepared by the NJDEP, Bureau of Planning and Assessment in March, 1991 (attachment 4). The report concluded that ground water contamination had resulted from the deposition of industrial sludges into unlined waste impoundments. The NJDEP recommended that the site be assigned a low

priority for further investigation and that a more thorough analysis be conducted on the waste sludges still in residence within the impoundments.

The NJDEP, Bureau of Site Assessment (SA) collected soil samples in October 1991 and completed a 'Site Investigation Report' in January of 1992 (attachment 3). The NJDEP found that in addition to cyanide, concentrations of base neutral compounds, inorganics and heavy metals exceeding background were detected. Specific contaminants detected included 2-methyl naphthalene, acenapthene, dibenzofuran, phenanthrene, fluoranthene, pyrene, benzo (a) anthracene, chrysene, benzo (b) fluoranthene, alpha chlordane, PCBs (aroclor 1254), zinc and cyanides. (attachment 2, pg.2-8) Cyanide was detected in each of the soil samples at concentrations ranging from 3.9 to 1,020 ppm (attachment 3, pg. 3-8). Because of the presence of contaminated soil and ground water at the site, SA recommended the site be transferred to the NJDEP, Division of Public Site Remediation, Bureau of State Case Management for further action.

In 1993, ownership of the Warners Plant and the Carteret Impoundments was transferred to Cytec Industries, Inc. An Amendment to the ACO was executed in August 1993 that required Cytec to evaluate potential contamination at the Carteret Impoundments (attachment 5). A Remedial Investigation Workplan (RIW) (attachment 6) was submitted to the NJDEP in December 1993. The RIW summarized all of the environmental data gathered at the site to date. The compilation of the environmental soil and sludge sampling data resulted in the discovery that with the exception of sporadic, seemingly anomalous sample results, all of the target compounds including VOCs, semi-VOCs, metals, PCBs, pesticides and cyanide were detected in concentrations less than the NJDEP Impact to Ground Water Soil Cleanup criteria. (attachment 6, pg. 6-5 to 6-7)

Ground water flow measurements for the Carteret Impoundments indicated that water table mounding occurs in the shallow aquifer beneath the impoundments. The mounded ground water is isolated from the more saline regional ground water by differences in density. Ground water in residence within the fractures and bedding planes of the Brunswick Formation are more representative of the native ground water. Regional flow in the Brunswick Formation occurs vertically and laterally toward the northeast with ultimate discharge into surface water bodies. Ground water within the Carteret Impoundment discharges into the lower Rahway River, Arthur Kill, and eventually the Atlantic Ocean. The ground water underlying the Carteret Impoundments is not classifiable as potable water due to the regional influence of saline waters from tidal surface water. (attachment 6, pg. 6-11) High chloride ion concentrations were detected in the ground water beneath the Carteret Impoundments and were thought to result from salt water from the Rahway River and the Arthur Kill displacing fresh ground water.

VOCs were detected only in the upgradient, shallow monitoring wells suggesting that there were off-site sources of the VOCs. In addition, there was no consistent detection of semi-VOCs, PCBs or pesticides. Inorganic analysis for three of the four downgradient monitoring wells indicated that concentrations of sodium, chloride, flouride, sulfate, cyanide and ammonia were elevated relative to the upgradient monitoring well, suggesting an on-site source of these compounds. Total Cyanide was detected in concentrations ranging between 1.98 and 64.5 ppm however, free cyanide represented less than one per cent of the total cyanide detected in the ground water samples. Free cyanide is present only in low concentrations because metal ions and ligands are available to remove free cyanide from solution, incorporating it into a complex. The resulting ferric and ferro cyanide is not expected to degrade into free cyanide. (attachment 6, pg. 6-13 to 6-17)

As with shallow ground water, samples of bedrock ground water also showed influence from salt-water intrusion. Total cyanide, lead and ammonia were detected in the bedrock ground water at concentrations that exceeded background concentrations. Lead was detected at concentrations averaging 7.8 and 7.1 in two downgradient monitoring wells which is less that the current NJDEP Standard of 10 ppb for Class IIA aquifers. Total cyanide concentrations in the bedrock ground water were substantially lower than those measured in shallow ground water. Total cyanide concentrations ranged between 0.03 and 5.24 ppb in the four monitoring wells located hydraulically down gradient relative to the background wells. The current NJDEP Class IIA Standard for cyanide is 200 ppb. No other inorganic constituents in the deep monitoring well samples were elevated relevant to the background sample. (attachment 6, pg. 6-17 to 6-18)

NJDEP comments regarding the RIW were received by Cytec and their consultants Blasland, Bouck and Lee, Inc. (BBL) in February 1994, and Cytec submitted a Remedial Action Plan (RAP) in April, 1994. The RAP outlined the procedures to be implemented for the operation, maintenance and monitoring program for the Carteret Impoundments. The RAP was amended (RAPA) and submitted in November 1994 (attachment 7). The RAPA summarized the long history of impoundment residue sampling and concluded that the results of the extensive sampling efforts suggest that the quality of the residue when compared to the NJDEP soil cleanup criteria was acceptable. (attachment 7, pg 7-3 to 7-6).

As part of the RAPA, Cytec performed a supplemental field investigation to further evaluate ground water quality and hydrologic conditions. As part of the investigation, three additional monitoring well pairs (six monitoring wells) were installed at the Carteret Impoundments in June of 1994.

The RAPA summarized ground water quality in the shallow and deep monitoring wells and included the six new monitoring wells. As before, there were no VOCs detected in the shallow aquifer except in the upgradient monitoring well. Cytec blames the occasional detection of gasoline compounds on the neighboring salvage yard. Other changes in ground water quality resulted from the leaching of the organic residues contained in the Carteret Impoundments. Aluminum, calcium, sodium, iron, cyanide, carbonate, and sulfate resulted from the production of alum and YPS. Total cyanide concentrations were detected above background in all eight shallow monitoring wells and the higher concentrations exceeded the NJDEP Class II-A Ground Water Quality Standards (GWQS). Free cyanide was detected in six of the monitoring wells. A review of historical data indicates that the concentrations of total cyanide were significantly decreasing and free cyanide had undergone no significant change. (attachment 7, pg 7-25)

The bedrock aquifer is overlain by a silty, weathered bedrock unit of variable thickness that represents a low conductivity water-bearing unit between the overburden (shallow) aquifer units and the bedrock aquifer. Cytec realized that the five monitoring wells initially installed at the ACL were screened in both the weathered bedrock unit and the competent bedrock unit. This screening configuration does not permit the assessment of the bedrock aquifer only and this is one of the reasons Cytec installed three additional monitoring well pairs. Each of the new deep monitoring wells was screened in the competent bedrock only. (attachment 7, pg 7-27)

Ground water in the competent bedrock was assessed by Cytec. Organic compounds were not detected but elevated concentrations of sodium, chloride, and total dissolved solids

(TDS) were detected. These compounds are indicative of salt-water intrusion. Total Cyanide concentrations were comparable to those measured in the shallow ground water. (attachment 7, pg 7-27)

Cytec noted that in the weathered bedrock monitoring wells, the concentrations of total cyanide seemed to be increasing over time. They were also aware that cyanide complexes commonly adhere to fine particles, organic complexes, and ligands. Cytec sampled the five weathered bedrock monitoring wells after two years of inactivity and observed that the ground water samples were turbid even after three purges. Cytec theorized that the turbidity of the sample was related to both the inferior quality of the monitoring well construction and the two years of inactivity which enabled the cyanide complexes, normally bound up in the weathered clay matrix, to flow into the monitoring well. (attachment 7, pp 7-30) The inflow of the turbid ground water into the monitoring well caused the cyanide concentrations to increase.

Surface water sampling revealed high concentrations of chloride, sulfate, and TDS, which was consistent with brackish water. In addition, a number of metals were detected in surface water samples collected from a number of different places. Only manganese was detected at concentrations that exceeded the criterion for human health. (attachment, pp 2-23 to 2-25)

After justifying their case for using NJDEP Alternate III-B GWQS, Cytec proposed a five-year monitoring plan to evaluate compliance with the Alternate III-B GWQS. The monitoring plan included both surface and ground water sampling. (attachment 7, pg 7-52) The NJDEP approved the proposed surface and ground water monitoring schedule outlined in the RAPA and five years of ground water monitoring was completed in 1999.

The five years of surface and ground water monitoring was summarized in a report titled 'Annual Monitoring Report for 1999'. (attachment 8) The initial sampling frequency was semi-annual but as stable or decreasing concentration trends were observed, Cytec received permission from the NJDEP to reduce their sampling frequency to annual. The analytical results for ground water and surface water samples collected as part of the five-year monitoring program were evaluated by comparison to the Class III-B GWQS and the SWQS as well as historical data. Although increasing trends of aluminum, iron, manganese, and free cyanide were observed at some well locations, the concentrations for these constituents were an order-of-magnitude less than the NJDEP Class III-B GWQS. Cytec requested that no further ground water sampling be required based upon this information.

Cytec also reported that surface water analytical results were less than the SWQS, with the exception of total manganese. Because the manganese concentrations were stable over time and only slightly exceeded human health standards, Cytec proposed to cease surface water monitoring at the ACL. (attachment 8, pp. 8-17 to 8-18) In a comment letter prepared based upon the RAPA, the NJDEP requested that Cytec continue surface water sampling until manganese concentrations were below SWQS in two consecutive events. Cytec agreed to collect additional surface water samples until the NJDEP conditions were met and presented the results of two sampling events in a letter to the NJDEP dated July 17, 2002. (attachment 9). Sampling events conducted in October 2001 and April 2002 resulted in the collection of surface water samples that were below the SWQS. As a result of the surface water sampling, Cytec proposed to end surface water sampling at the ACL. Cytec followed up with a letter requesting NFA and Covenant Not to Sue on September 19, 2002. (attachment 10) The NJDEP approved the request in a letter dated September 24, 2002 (attachment 1).

Current Hazard Assessment

The deposition of chemical wastes in the American Cyanamid Landfill was stopped in 1973. Cyanamid (now Cytec) conducted a number of environmental investigations to assess the quality of ground water and surface water at the ACL. These investigations culminated with a NFA and Covenant Not to Sue issued by the NJDEP in September 2002. Cytec determined that their sampling results met the regulatory requirements for Class III-B GWQS and SWQS. Class III-B GWQS are site specific and became applicable at the ACL due to brackish water in the shallow and deep aquifers. These GWQS are less stringent than those applicable for potable aquifers.

Therefore, based on NJDEP long-term oversight of remedial activities and the resulting NFA determination issued by the NJDEP, there is no uncontrolled waste source currently present at the ACL.

Sources

There are no hazardous substances exceeding their relevant Quality Standards remaining at the ACL.

Ground Water Migration Pathway

The ACL is located on the boundary between the Piedmont and the Coastal Plain Physiographic Provinces. Surficial deposits consist of 20 to 40 feet of Quaternary alluvium composed of interbedded silt, sand, gravel and clay with buried peat and organic-rich horizons. Bedrock at the base of the alluvium is the Triassic age Brunswick Formation consisting of dense, hard, red siltstone.

The shallow ground water may occur at as little as two feet below the ground surface in a zone consisting of fill material, meadow mat, and black organic-rich sandy silt. Shallow ground water is mounded beneath the impoundments and flows radially outward from the center of the impoundments. Shallow ground water discharges primarily into the surrounding surface water bodies, primarily Cross Creek and the Rahway River. Recharge of the bedrock aquifer from the shallow ground water is limited by a thick clay layer near the contact.

The Brunswick Formation contains the deep ground water in the area and transmits ground water through a system of joints and fractures within the siltstone. Ground water flow of the deeper ground water is to the north or northeast where it also discharges into the Raritan River. (attachment 3, page 3-3)

The potential exposure pathway for ground water involves the discharge to surface water, primarily due to the lack of water supply wells in the vicinity of the ACL. The potable use of surface water down-river of the ACL is neither a realistic or anticipated use. Residents of the Borough of Carteret are provided water by the Middlesex Water Company, which uses the Delaware and Raritan Canal as its principal water source. The Delaware and Raritan Canal is owned by the state of New Jersey and operated by the New Jersey Water Supply

Authority. Exposure via the residential pathway (i.e., ground water ingestion) is unlikely. (attachment 7, pg. 7-41)

Ground Water Migration Pathway Targets

There are no water supply wells located within 4 miles of the ACL.

Due to the brackish ground water at the ACL, and the improbable use of ground water downgradient of the ACL, there are no ground water pathway targets. (Map 5)

Surface Water Migration Pathway

The ACL borders over 1 mile of shoreline along the Rahway River which discharges into the Arthur Kill approximately 1,600 feet to the southeast. The Arthur Kill flows approximately 10 miles to Raritan Bay. Oyster Creek and Deep Creek flow through the eastern portion of the site and Cross Creek is located on the western boundary of the site. All 3 creeks receive ground water discharge from the ACL and all 3 creeks discharge into the Rahway River. (attachment 3, page 3-4)

Surface Water Migration Pathway and Targets

The closest New Jersey surface water withdrawal point to the ACL is an intake located on Morses Creek at the Bayway refinery. The refinery is located more than two miles and in an up-river position relative to the ACL.

NJDEP's designated uses for the Rahway River and the Arthur Kill limit potential receptors to individuals involved in secondary contact recreation or to aquatic or semi-aquatic organisms. Secondary contact includes those activities, such as boating or fishing, where the probability of water ingestion is minimal. Potential exposures include inhalation of volatile emissions or aerosols during secondary contact recreation, and ingestion of edible fish or shellfish tissue that has bioaccumulated contaminants of concern.

Volatile emissions would be minimal due to the infrequent detection of low concentrations of VOCs detected in ground water samples from one of eight pairs of on-site monitoring wells and the large extent of ground water dilution occurring in surface water. Additionally, the air mixing conditions prevailing over the Hudson-Raritan Estuary would rapidly reduce VOC concentrations. All of these factors would effectively mitigate potential inhalation exposure concentrations.

Although bioaccumulation is a potential exposure pathway, it is not believed to be significant for several reasons; first, because the consumption of certain fish or shellfish caught in the Hudson-Raritan Estuary is restricted by NJDEP, although the effectiveness of this restriction is uncertain; and, second, most of the inorganic contaminants of concern detected in the ground water have not been demonstrated to either bioconcentrate or biomagnify in the aquatic or terrestrial food chain. Therefore, exposure via bioaccumulation, in the unlikely event of consumption of fish or shellfish, is not considered an important pathway.

(attachment 7, p. 7-43) Map 7 is a map summarizing the wetlands vegetation in the vicinity of the ACL and Map 8 presents the floodplain information for the ACL.

Soil Exposure Pathway

The northern 75 per cent of the ACL is underlain by psamments, waste substratum (PW), while the remainder of the site is underlain by sulfaquents and sulfihemists, frequently flooded (SU). The PW unit consists of excessively drained to well-drained soils that have mainly been used to cover landfills. The material is generally 2 - 4 feet thick. The SU unit is level, very poorly drained organic soils in tidal marsh areas that are subject to tidal flooding. Generally, the sulfaquents have a surface area of mucky silt loam over a sandy substratum. Sulfihemists are mucky soils that range in thickness from 18 to 60 inches. The permeability of this unit is moderate and the ground water table occurs near the surface. (attachment 3, page 3-5 to 3-6)

With the exception of sporadic, seemingly anomalous sample results, all of the target compounds including VOCs, semi-VOCs, metals, PCBs, pesticides and cyanide were detected in concentrations less than the NJDEP Impact to Ground Water Soil Cleanup criteria. The ACL is currently gated with locked fences that restrict access. The Rahway River is also a barrier to access.

Soil Exposure Pathway Targets

There are approximately 7,800 residents within 1 mile of the ACL. Located within 4 miles of the ACL are approximately 125,000 New Jersey Residents. Staten Island, New York is located east of the ACL and is separated from New Jersey by the Arthur Kill. Most of the Staten Island population is located between one and four miles from the ACL. The total population located within four miles of the ACL is approximately 225,000. (attachment 11, Map 6) Due to considerable access restrictions to the ACL, a direct contact soil exposure pathway does not exist

Air Exposure Pathway

A release to the air migration pathway was neither observed nor expected. Prior to the growth of a vegetative cover on the landfill, there were issues of wind-borne soil and dust on to neighboring properties. With the vegetative cover, this is no longer an issue.

Air Exposure Pathway Targets

There are approximately 225,000 people that reside within 4 miles of the ACL. Due to the vegetative cover on the surface of the landfill, an air exposure pathway does not exist

Conclusion

The American Cyanamid Landfill has been the focus of environmental investigations under the current owner Cytec Industries, Inc. Cytec entered into an amended Administrative Consent Order with the NJDEP in August 1993 requiring an evaluation of all potential contamination at the Carteret Impoundments. The only waste streams that were received by the impoundments were waste slurries resulting from the production of alum and the production of yellow prussiate of soda. The two million tons of wastes deposited in the Carteret Impoundments have been untouched since their deposition ceased in the early 1970's.

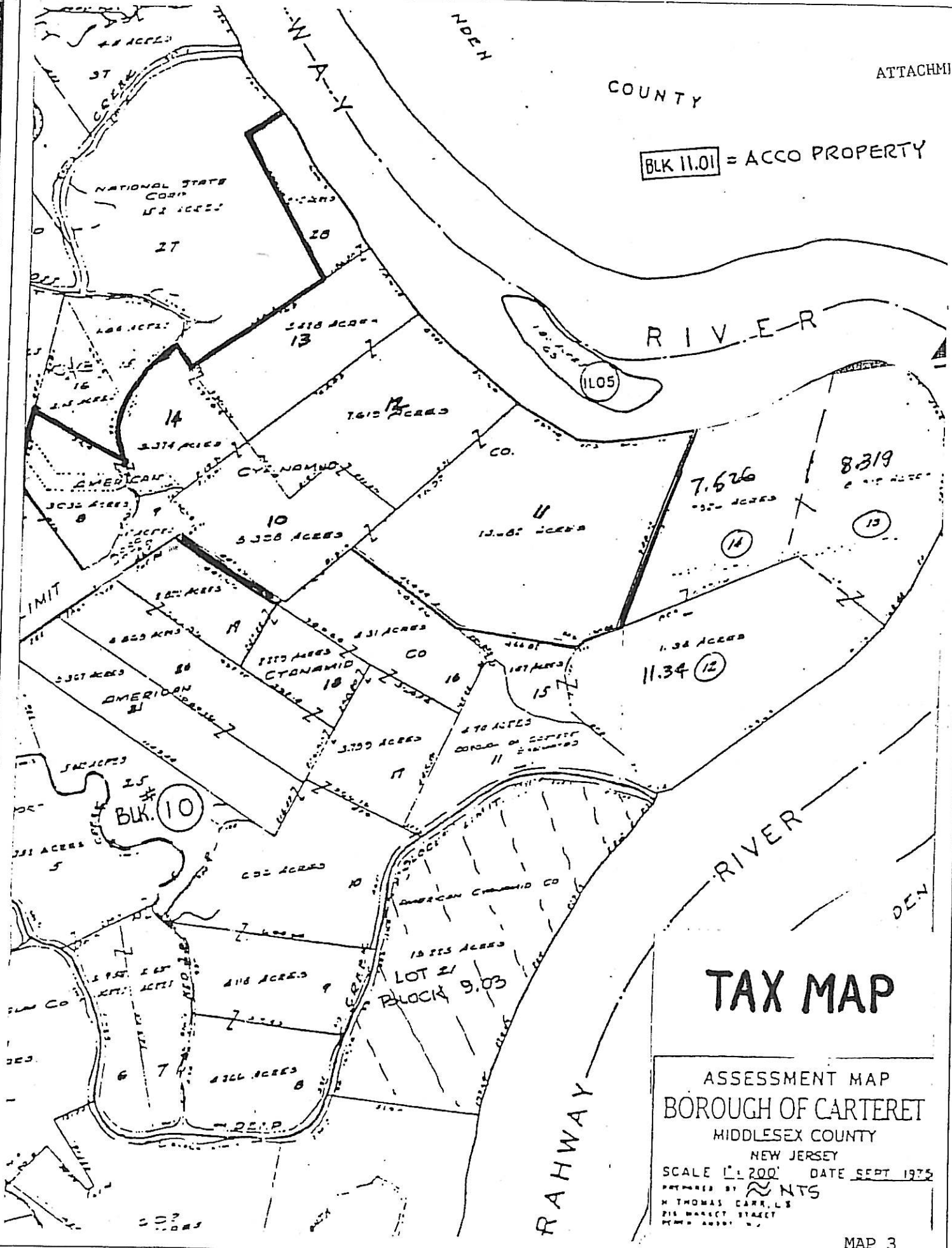
In December 1993, and in response to the ACO, Cyanamid submitted a Remedial Investigation Workplan to the NJDEP that summarized all of the environmental data collected at the ACL to date. Significant to the report was the observation that with the exception of seemingly random, anomalous sample results, all contaminants of concern detected in the soils and on-site sludges, were detected in concentrations that were less than the current NJDEP Impact to Ground Water Soil Cleanup Criteria. The Amended Remedial Action Plan submitted in November 1994 arrived at the same conclusion. The only remedial activity related to the sludge and soils at the ACL was the establishment of a vegetative cover on the surface of the ACL that limited the air borne migration of dust and sediments.

A strategy for further ground water investigation was also included in the Amended Remedial Action Plan. Six additional monitoring wells were constructed and all of the monitoring wells were sampled over a period of five years. Cytec submitted the Annual Monitoring Report for 1999 that summarized the ground water sampling results. Ground water concentration data was compared to the NJDEP Class III-B GWQS. Noted in the summary report were increasing concentrations of aluminum, iron, manganese and free cyanide in some of the monitoring well locations but the compounds were at least an order of magnitude less than the NJDEP Class III- B GWQS. The brackish nature of the ground water beneath the ACL precludes its use as a viable source of drinking water

Surface water quality standards were met by Cytec in April 2002 when two surface water samples collected in consecutive sampling events had concentrations of manganese below the NJDEP SWQS. .

The overall site score for the American Cyanamid Landfill is 0.32. Based upon a review of historical information, analytical data, and the HRS score compiled for the purpose of the Site Reassessment, a recommendation of No Further Remedial Action Planned (NFRAP) under CERCLA is being issued for the American Cyanamid Landfill Site. The natural attenuation of the soils, sludges and ground water as well as NJDEP oversight of the investigation are responsible for the NFRAP recommendation.

ATTACHMI



MAP 3